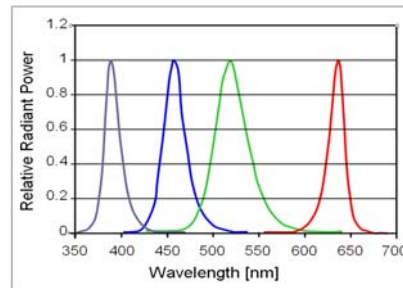


## High performance LED illuminator for measurements using imaging techniques

### General description

The LED illuminator is designed to provide continuous (CW) and pulsed light for high-speed videography and image based measurement techniques such as PIV (Particle Image Velocimetry), BOS (Background Oriented Schlieren), PROPAC (Projected Pattern Correlation), IPCT (Image Pattern Correlation Technique), shadowgraphy and schlieren.

The device generates extremely bright, non-coherent light. Available colors are red (623 nm), green (528 nm) blue (462 nm) or UV (390 nm). A version with white light emission is in preparation. The pulsed intensity is up to 14,000 lm (528 nm). The programmable delay allows the flashes to be precisely synchronized with different cameras.



All of the parameters of the device can be adjusted using control software via an USB interface. These include:

- continuous light intensity
- pulse trigger mode
- active trigger pulse edge
- single or dual pulse mode (PIV)
- light pulse width
- light pulse power
- pulse delay
- pulse rate limitation

The parameters set using the computer are saved in non-volatile memory in the illuminator. This allows the device to be independently operated without a computer.

Pushbuttons on the rear of the housing allow the user to choose the operational mode, turn the continuous light on and off, and trigger individual flashes.

The operating temperatures of the LED and power electronics are monitored. Separate temperature-controlled fans are used for active cooling.

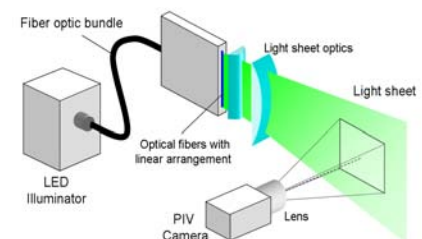
A variety of measures are used to protect the LED from being destroyed due to incorrect settings. The program monitors the pulse intensity, pulse length and maximum pulse frequency and dynamically adjusts the maximum values selectable by the user.

Both the status of the device and any errors are displayed on the back of the device and in the software program.

### Lenses and Fiber Optics

The illuminator is equipped with various C-mount lenses. It generates a defined, highly homogenous round illumination field of defined diameter suitable for imaging applications such as videographic recording, BOS and IPCT

In addition, light guides, for example from Schott, Fostec, Dolan-Jenner or Qioptiq can be connected to the device using an adapter.



The diagram above shows a possible configuration using a fiber line light to generate a light sheet for use in PIV. In this arrangement the LED illuminator enables high-speed PIV fluid flow measurements at kHz frame rates.

### Applications

- Fluid mechanics
  - Particle image velocimetry
  - Schlieren imaging
- Quality assurance
- Machine vision
- Deformation measurements
- Video stroboscopy
- High-speed videography

### Internal single pulse mode

In this mode, light flashes are triggered by an external TTL signal.

The following parameters can be set with the program:

- pulse current from 20 A to 250 A
- pulse width from 200 ns to 300  $\mu$ s, in steps of 50 ns
- delay between the selected trigger edge and the light pulse emission from 0 to 100 ms, in steps of 50 ns
- maximum light pulse frequency for safe operation

### Internal double pulse mode

In this mode, two flashes are triggered with a single external trigger pulse (PIV or double exposure imaging applications).

The following parameters can be set with the program:

- pulse current from 20 A to 250 A
- delay between the selected trigger edge and the first light pulse of 0 to 100 ms, in steps of 50 ns
- pulse width of the first light pulse from 200 ns to 300  $\mu$ s, in steps of 50 ns
- delay between the first and the second light pulse from 0 to 100 ms, in steps of 50 ns
- pulse width of the second light pulse from 200 ns to 300  $\mu$ s, in steps of 50 ns.

### External pulse mode

The light pulse width is determined by the width of an external trigger pulse. The pulse current can be set by software. The parameters are continuously monitored by the software and dynamically limited if necessary.



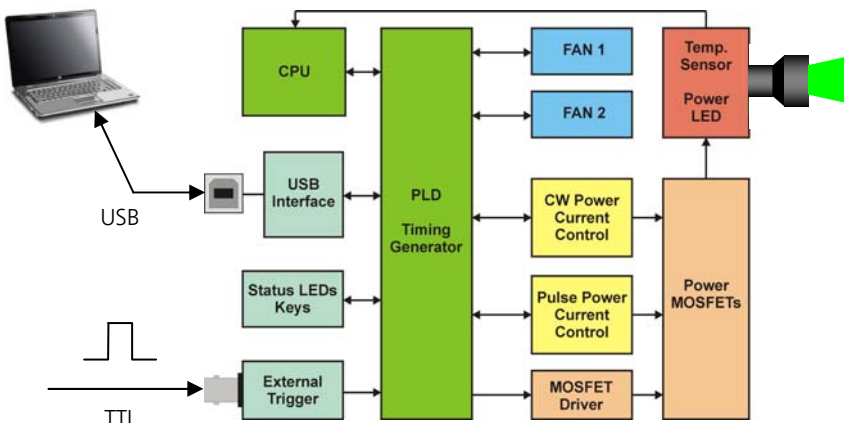
## Operational Modes

### CW mode

In CW mode, the device generates continuous light whose intensity can be adjusted by software by varying the LED current between 3 A and 18 A. The thermal design of the device allows for continuous operation at full light intensity. The CW light can be externally controlled with a TTL signal connected to the BNC connector. A low potential (0 V) or a connection to ground of this input terminates the light emission.

### Error display on the rear housing

- Power error - the supply voltage lies outside of the permissible range of 18 to 36 VDC
- Fan failure - the fan is defective
- Temperature - the LED temperature is too high
- Pulse width - the pulse width is too wide and has been limited
- Frequency - the trigger frequency was exceeded and has been limited



Device names: IL104R (red), IL104G (green), IL104B (blue), IL104UV (ultraviolet)

### General specifications

Pulse rate	0 to 1 MHz
Supply voltage	24 VDC
Supply voltage range	(18 V-36 V)
Power consumption	5 A max.
Dimensions (WxHxD)	115x170x130 mm <sup>3</sup>
Weight	approx. 2.8 kg

### Luminous flux / radiometric power (green LED)

CW @18 A DC	2,300 lm (4.1 W)
Pulsed 2 $\mu$ s @ 250 A	14,000 lm (24 W)
Comparison:	
Halogen rod 500 W	9,500 lm